

Plastics piping systems for water supply — Unplasticized poly (vinyl chloride) (PVC-U) —

Part 1: General

The European Standard EN 1452-1:1999 has the status of a
British Standard

ICS 23.040.01; 91.140.60

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National foreword

This British Standard is the official English language version of EN 1452-1:1999. Collectively, Parts 1, 2, 3, 4 and 5 of BS EN 1452 supersede BS 3505:1986, BS 4346-1:1969 and BS 4346-2:1990. Since those British Standards are the basis of piping systems with a design life of at least 50 years, it is intended that they will be declared obsolescent, by 26 June 2001. Collectively, Parts 1 to 5 of BS EN 1452 also partially supersede BS 4346-3:1982, which will be withdrawn or amended by 26 June 2001 to exclude requirements for joints for pressure pipes for water supply.

NOTE 1 The UK Water Industry has indicated that this British Standard is to be regarded as superseding the following Water Industry Specifications:
 WIS 4-31-06, Issue 2: March 1994 *Blue unplasticised PVC pressure pipes, integral joints and post-formed bends for cold potable water (underground use)*
 WIS 4-31-07, Issue 2: March 1994 *Unplasticised PVC pressure fittings and assemblies for cold potable water (underground use)*

The UK participation in its preparation was entrusted by Technical Committee PRI/61, Plastics piping systems and components, to Subcommittee PRI/61/2, Thermoplastics piping systems and components for pressure applications, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This British Standard, having been prepared under the direction of the Sector Committee for Materials and Chemicals, was published under the authority of the Standards Committee and comes into effect on 15 May 2000

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Amendments issued since publication

Amd. No.	Date	Comments

The responsible UK committee gives the following advice concerning the selection and installation of piping systems and components conforming to this British Standard.

a) Water supply companies and other entities are obliged to use Parts 1 to 5 of this suite of European Standards, produced under EC/U mandate, if they wish to purchase PVC-U pipe systems or components within its scope.

NOTE 2 Parts 6 and 7 have each been prepared as an ENV (pre-standard), to allow further development, and their use is voluntary unless invoked contractually.

b) Where there are options, care should be taken to ensure that agreement is established between suppliers and purchasers, e.g. in terms of colour, size, physical characteristics, effect on water quality, quality assurance.

For colour in particular, it has been the practice of UK water companies to use blue metric PVC-U pipes (conforming to WIS 4-31-06), to facilitate identification of potable water pipelines. For buried applications in the United Kingdom, attention is drawn to the recommendations of the National Joint Utilities Group (NJUG) concerning the colour coding of pipelines and other services. For UK public water supply applications, the pipes should also be marked with the word "WATER".

c) To guard against leakage or contamination as a result of biodegradation of elastomeric sealing rings or gaskets used in piping systems, it has been UK practice to specify a test for this. Elastomeric seals appropriate for the cold water applications should be specified to conform to type WA in BS EN 681-1:1996. However, the requirement for resistance to biodegradation is specifically excluded from the scope of that standard. BS 7874 specifies an appropriate test; attention is drawn to its foreword for guidance on requirements.

d) Attention is drawn to the formula in 3.1.4.4, which is considered to have potentially dangerous implications as presented, without units. To reflect use in the relevant Directives and operating procedures, the preferred UK equivalent is:

$$\sigma = \frac{p(d_{em} - e)}{20e}$$

where:

σ is in megapascals (MPa)

p is in bar

d_{em} and e are in millimetres (mm).

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

WARNING This British Standard, which is identical with EN 1452-1:1999, does not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at work etc. Act 1974 and subsequent regulations. Attention should be paid to any appropriate safety precautions and the test methods should be performed only by trained personnel.

Regulation 25 of the Water Supply (Water Quality) Regulations 1989 specified the circumstances in which water undertakers may use products in contact with public water supplies in England and Wales. All pipes used to convey public water supplies must be approved under the provisions of regulation 25(1)(a) in order to ensure that use will not cause adverse effect on water quality or risk to health of consumers. Similar provisions apply in Scotland and Northern Ireland.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

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EUROPEAN STANDARD
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EN 1452-1

June 1999

ICS 23.040.90

English version

**Plastics piping systems for water supply – Unplasticized
poly(vinyl chloride) (PVC-U) – Part 1: General**

Systèmes de canalisations en plastique pour alimentation
en eau – Poly(chlorure de vinyle) non plastifié (PVC-U) –
Partie 1: Généralités

Kunststoff-Rohrleitungssysteme für die Wasserversorgung
– Weichmacherfreies Polyvinylchlorid (PVC-U) – Teil 1:
Allgemeines

This European Standard was approved by CEN on 2 July 1998.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 155, Plastics piping systems and ducting systems, the Secretariat of which is held by NNI. It has been prepared with the cooperation of Eureau and in liaison with CEN/TC 164, Water supply.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 1999, and conflicting national standards shall be withdrawn at the latest by June 2001.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This standard forms part of a System Standard for plastics piping systems of a particular material for a specified application. There are a number of such System Standards.

System Standards are based on the results of the work undertaken in ISO/TC 138, Plastics pipes, fittings and valves for the transport of fluids, which is a Technical Committee of the International Organization for Standardization (ISO).

They are supported by separate standards on test methods to which references are made throughout the System Standard.

The System Standards are consistent with general standards on functional requirements and on recommended practice for installation.

EN 1452 consists of the following parts, under the general title *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U)*:

- Part 1: *General (the present standard)*;
- Part 2: *Pipes*;
- Part 3: *Fittings*;
- Part 4: *Valves and ancillary equipment*;
- Part 5: *Fitness for purpose of the system*;
- Part 6: *Guidance for installation (ENV)*;
- Part 7: *Guidance for assessment of conformity (ENV)*.

This part of EN 1452 includes the following annex:

Annex A (informative): Bibliography.

At the date of publication of this standard, System Standards for piping systems of other plastics materials used for the same application are the following:

NOTE The listed System Standards are in preparation.

prEN 1796, *Plastics piping systems for water supply with or without pressure — Glass-reinforced thermosetting plastics (GRP) based on polyester resin (UP)*;

prEN 12201, *Plastics piping systems for water supply — Polyethylene (PE)*.

Introduction

The System Standard, of which this is Part 1, specifies the requirements for a piping system and its components made from unplasticized poly(vinyl chloride) (PVC-U). The piping system is intended to be used for water supply.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the products covered by EN 1452:

- 1) this System Standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;
- 2) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of these products remain in force.

For components, requirements and test methods are specified in Parts 2, 3 and 4 of EN 1452. Characteristics for fitness for purpose (mainly for joints) are covered in Part 5. Guidance for installation is given in ENV 1452-6. ENV 1452-7 covers guidance for the assessment of conformity.

This part of EN 1452 covers the general aspects of the plastics piping system.

1 Scope

This part of EN 1452 specifies the general aspects of unplasticized poly(vinyl chloride) (PVC-U) piping systems in the field of water supply.

In conjunction with Parts 2 to 5 of EN 1452 it is applicable to PVC-U pipes, fittings, valves and ancillary equipment, their joints and to joints with components of other plastics and non-plastics materials intended to be used for the following:

- a) water mains and services buried in ground;
 - b) conveyance of water above ground for both outside and inside buildings;
- for the supply of water under pressure at approximately 20 °C (cold water) intended for human consumption and for general purposes.

This standard is also applicable to components for the conveyance of water up to and including 45 °C.

NOTE For temperatures between 25 °C and 45 °C figure A.1 given in annex A of EN 1452-2:1999 applies.

2 Normative references

This standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO 472:1996, *Plastics — Vocabulary*

ISO 1043-1:1997, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO 4065:1996, *Thermoplastics pipes — Universal wall thickness table*

3 Definitions, symbols and abbreviations

For the purposes of this standard, the following definitions, symbols and abbreviations apply.

3.1 Definitions

In addition to the definitions given below, the definitions given in ISO 472:1996 and ISO 1043-1:1997 apply.

NOTE If not already included in this standard, the designations as required by prEN 805 and prEN 806-1 will be considered in due course.

3.1.1 Geometrical definitions

3.1.1.1 Nominal size

3.1.1.1.1

nominal size DN

A numerical designation of the size of a component, other than a component designated by thread size, which is a convenient round number approximately equal to the manufacturing dimension in millimetres (mm).

3.1.1.1.2

nominal size DN/OD

Nominal size, related to the outside diameter.

3.1.1.1.3

nominal size DN/ID

Nominal size, related to the inside diameter.

3.1.1.2**nominal diameter (d_n)**

The specified diameter, in millimetres, assigned to a nominal size.

NOTE According to EN 1452, the nominal (outside) diameter of a thermoplastics pipe or a spigot, is equal to its minimum mean outside diameter, $d_{em,min}$.

The nominal (inside) diameter of the socket of a fitting, pipe, valve or of ancillary equipment is equal to the nominal (outside) diameter of the connecting pipe for which they are designed.

3.1.1.3**outside diameter (at any point) (d_e)**

The value of the measurement of the outside diameter through its cross-section at any point of a pipe or spigot, rounded to the next greater 0,1 mm.

3.1.1.4**mean outside diameter (d_{em})**

The value of the measurement of the outer circumference of a pipe or spigot end of a fitting in any cross-section, divided by π ($\approx 3,142$), rounded to the next greater 0,1 mm.

3.1.1.5**mean inside diameter of socket (d_{im})**

The arithmetical mean of two measured inside diameters perpendicular to each other at the midpoint of the socket length.

3.1.1.6**out-of-roundness (ovality)**

The difference between the measured maximum and the measured minimum outside diameter in the same cross-section of a pipe or spigot, or the difference between the measured maximum and the measured minimum inside diameter in the same cross-section of a socket.

3.1.1.7**nominal wall thickness (e_n)**

A numerical designation of the wall thickness of a component which is identical to the minimum permissible wall thickness in millimetres at any point.

3.1.1.8**wall thickness (at any point) (e)**

The value of the measurement of the wall thickness at any point around the circumference of a component.

3.1.1.9**mean wall thickness (e_m)**

The arithmetical mean of a number of measurements of the wall thickness, regularly spaced around the circumference and in the same cross-section of a component, including the measured minimum and the measured maximum values of the wall thickness in that cross-section.

3.1.1.10**tolerance**

The permitted variation of the specified value of a quantity, expressed as the difference between the permitted maximum and the permitted minimum value.

3.1.1.11**pipe series S**

A dimensionless number for pipe designation (see ISO 4065:1996).

NOTE The pipe series S is related to a given pipe geometry as follows:

$$[S] = \frac{d_n - e_n}{2e_n}$$

3.1.1.12**standard dimension ratio (SDR)**

A numerical designation of a pipe series which is a convenient round number approximately equal to the dimension ratio of the nominal outside diameter, d_n , and the nominal wall thickness, e_n .

NOTE According to ISO 4065:1996 the standard dimension ratio, SDR, and the pipe series S are related as follows:

$$[\text{SDR}] = 2[\text{S}] + 1$$

3.1.2 Material definitions**3.1.2.1****virgin material**

Material in the form of granules or powder that has not been subjected to use or processing other than that required for its manufacture and to which no reprocessible or recyclable material(s) have been added.

3.1.2.2**own reprocessible material**

Material prepared from rejected unused pipes and fittings, including trimmings from the production of pipes and fittings, that will be reprocessed in a manufacturer's plant after having been previously processed by the same manufacturer by a process such as moulding or extrusion and for which the complete formulation is known.

3.1.2.3**external reprocessible material**

Material comprising either one of the following forms:

- a) material from rejected unused pipes or fittings or trimmings therefrom, that will be reprocessed and that were originally processed by another manufacturer;
- b) material from the production of unused PVC-U products other than pipes and fittings, regardless of where they are manufactured.

3.1.2.4**recyclable material**

Material comprising either one of the following forms:

- a) material from used pipes or fittings which have been cleaned and crushed or ground;
- b) material from used PVC-U products other than pipes or fittings which have been cleaned and crushed or ground.

3.1.3 Definitions related to material characteristics**3.1.3.1****lower confidence limit (LCL)**

A quantity, expressed in megapascals (MPa), which can be considered as a material property, representing the 97,5 % lower confidence limit of the predicted long-term hydrostatic strength for water at 20 °C for 50 years.

3.1.3.2**minimum required strength (MRS)**

The value of LCL, rounded to the next lower value of the R10 series when the LCL is below 10 MPa, or to the next lower value of the R20 series when the LCL is 10 MPa or greater.

NOTE R10 and R20 series are the Renard number series conforming to ISO 3:1973 and ISO 497:1973.

3.1.3.3**overall service (design) coefficient (C)**

An overall coefficient with a value greater than one, which takes into consideration service conditions as well as properties of the components of a piping system other than those represented in the LCL.

**3.1.3.4
design stress (σ_s)**

The allowable stress, in megapascals, for a given application. It is derived from the MRS by dividing it by the coefficient, C, i.e.:

$$\sigma_s = \frac{[MRS]}{C}$$

3.1.4 Definitions related to service conditions**3.1.4.1
nominal pressure (PN)**

A numerical designation of a component of a piping system related to the mechanical characteristics of that component used for reference purposes. For plastics piping systems it corresponds to the allowable operating pressure, in bar ¹⁾, conveying water at 20 °C during 50 years.

**3.1.4.2
allowable operating pressure (PFA)**

The maximum hydrostatic pressure that a component is capable of withstanding continuously in service (excluding surge).

For water temperatures up to 25 °C: [PFA] = [PN]

For water temperatures above 25 °C: [PFA] = f_T × [PN]

where:

f_T is the derating factor depending on water temperature;

PN is the nominal pressure.

NOTE In cases where a further derating (or uprating) factor for application is required: [PFA] = f_A × f_T × [PN], where f_A is the factor depending on the application.

**3.1.4.3
allowable site test pressure (PEA)**

The maximum hydrostatic pressure that a newly installed component is capable of withstanding for a relatively short duration, in order to ensure the integrity and leaktightness of the pipeline.

NOTE For this standard [PEA] equals 1,5 × [PFA], with a maximum of [PFA] + 5 bar.

**3.1.4.4
hydrostatic stress (σ)**

The stress induced in the wall of a pipe, in megapascals, when a pressure is applied using water as a medium. The hydrostatic stress is related to the applied pressure p , in bar, the wall thickness at any point, e , and the mean outside diameter, d_{em} , of a pipe and calculated using the following approximation equation:

$$\sigma = \frac{10p(d_{em} - e)}{2e}$$

3.1.5 Definitions for pipe joints**3.1.5.1
end-load-bearing joint**

A joint which can resist axial loads without additional external mechanical support.

**3.1.5.2
non-end-load-bearing joint**

A joint which cannot resist axial loads without additional external mechanical axial support.

¹⁾ 1 bar = 10⁵ N/m² = 0,1 MPa.

3.2 Symbols

C	: overall service (design) coefficient
d_e	: outside diameter (at any point)
d_{em}	: mean outside diameter
d_i	: inside diameter (at any point)
d_{im}	: mean inside diameter of socket
d_n	: nominal (outside or inside) diameter
DN	: nominal size
DN/ID	: nominal size, inside diameter related
DN/OD	: nominal size, outside diameter related
e	: wall thickness (at any point)
e_m	: mean wall thickness
e_n	: nominal wall thickness
f_A	: derating (or uprating) factor for application
f_T	: derating factor for water temperatures
σ	: material density
σ	: hydrostatic stress
σ_s	: design stress

3.3 Abbreviations

LCL	: lower confidence limit
MRS	: minimum required strength
PFA	: allowable operating pressure (French: Pression de Fonctionnement Admissible)
PEA	: allowable site test pressure (French: Pression d'Épreuve Admissible)
PN	: nominal pressure
PVC-U	: unplasticized poly(vinyl chloride)
PVC-UH	: unplasticized poly(vinyl chloride) material for injection-moulded components, such as fittings or valve bodies, with a proved MRS-value of at least 25 MPa
R	: series of preferred numbers
S	: pipe series
SDR	: standard dimension ratio
TIR	: true impact rate
VCM	: vinyl chloride monomer

4 Material

4.1 PVC-U compound

The material from which the pipes, fittings and valves are made shall be an unplasticized poly(vinyl chloride) compound. This compound shall consist of PVC-U resin, to which are added those additives that are needed to facilitate the manufacture of pipes, fittings and valves conforming to Part(s) 2, 3, 4 and 5 of EN 1452, as applicable.

None of these additives shall be used separately or together in quantities sufficient to constitute a toxic, organoleptic or microbiological hazard or to impair the fabrication or solvent cementing properties of the product or to impair the chemical and physical or mechanical properties (in particular long-term mechanical strength and impact strength) as specified in the applicable part(s) of EN 1452.

4.2 Influence on water intended for human consumption

All plastics and non-plastics materials for components of the PVC-U piping system, e.g. elastomeric sealing rings, solvent cement, lubricants, when in permanent or in temporary contact with water, which is intended for human consumption, shall not adversely affect the quality of the drinking water.

NOTE European Standards on test methods for the assessment of migration, of odour and flavour and for microbiological assessment are under preparation.

4.3 Reprocessable and recyclable materials

The use of the manufacturer's own reprocessable material obtained during the production and works testing of products conforming to this standard is permitted in addition to the use of virgin material. Reprocessable material obtained from external sources and recyclable material shall not be used.

Annex A (informative)

Bibliography

- prEN 805, *Water supply — Requirements for systems and components outside buildings*
- prEN 806-1, *Specification for installations inside buildings conveying water for human consumption — Part 1: General*
- EN 1452-2, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U) — Part 2: Pipes*
- EN 1452-3, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U) — Part 3: Fittings*
- EN 1452-4, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U) — Part 4: Valves and ancillary equipment*
- EN 1452-5, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U) — Part 5: Fitness for purpose of the system*
- ISO 3:1973, *Preferred numbers — Series of preferred numbers*
- ISO 497:1973, *Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers*

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